## CLAIMS

1. An electron emission device comprising:

an emitter electrode;

an extractor electrode; and

a solid-state field controlled emitter having a Schottky metal-semiconductor junction fabricated on the emitter electrode and electrically coupled to the extractor electrode such that an electric potential placed between the emitter electrode and the extractor electrode results in field emission of electrons from an exposed surface of the semiconductor layer of the Schottky metal-semiconductor barrier.

2. The electron emission device according to claim 1 further comprising a focusing electrode electrically coupled to the solid-state field controlled emitter.

3. The electron emission device according to claim 1 wherein the solid-state field controlled emitter utilizes Pt as the Schottky metal.

4. The electron emission device according to claim 1 wherein the solid-state field controlled emitter utilizes $TiO_2$ as the semiconductor.

5. The electron emission device according to claim 1 further comprising a dielectric placed between the emitter electrode and the extracting electrode.

6. The electron emission device according to claim 2 further comprising a second dielectric placed between the extracting electrode and the focusing electrode.

7. The electron emission device according to claim 1 wherein the solid-state field controlled emitter is a flat emitter.

8. The electron emission device according to claim 1 wherein the solid-state field controlled emitter conforms to a tip-based geometry.

9. A process for fabricating electron emission devices, comprising:

forming an emitter electrode layer;

forming an extracting electrode layer proximate the conductive semiconductor layer;

forming an aperture through a portion of the extracting electrode layer to expose a portion of the emitter electrode layer;

forming a Schottky metal layer on the emitter electrode layer through the aperture; and

forming a conductive semiconductor layer on the Schottky metal layer through the aperture, thereby forming a solid-state field controlled emitter.

10. A process for fabricating electron emission devices according to claim 9 wherein the Schottky metal layer forming step comprises selecting Pt as the Schottky metal layer.

11. A process for fabricating electron emission devices according to claim 9 wherein the semiconductor layer forming step comprises selecting $TiO_2$ as the conductive semiconductor layer.

12. A process for fabricating electron emission devices according to claim 9 also comprising the step of forming a focus electrode layer above the extracting electrode layer prior to the Schottky metal layer forming step.

13. A process for fabricating electron emission devices according to claim 9 further comprising forming a spacer dielectric between the emitter electrode layer and the extracting electrode layer.

14. A process for fabricating electron emission devices according to claim 12 further comprising forming a second dielectric layer between the extracting electrode layer and the focusing electrode layer.

15. A storage apparatus comprising:

a storage medium having at least one storage area, the storage area being in one of a plurality of states to represent the information stored in that storage area;

at least one electron emission device to generate an electron beam current utilized to read and write the information stored in the storage areas, the electron emission device comprising:

an emitter electrode;

an extractor electrode; and

a solid-state field controlled emitter having a Schottky metal-semiconductor junction fabricated on the emitter electrode and electrically coupled to the extractor electrode.

16. The storage apparatus according to claim 15 wherein the electron emission device further comprises a focusing electrode electrically coupled to the solid-state field controlled emitter.

17. The storage apparatus according to claim 15 wherein the solid-state field controlled emitter utilizes Pt as the Schottky metal.

18. The storage apparatus according to claim 15 wherein the solid-state field controlled emitter utilizes $TiO_2$ as the semiconductor.

19. The storage apparatus according to claim 15 wherein the electron emission device further comprises a dielectric placed between the emitter electrode and the extracting electrode.

20. The storage apparatus device according to claim 16 wherein the electron emission device further comprises a second dielectric placed between the extracting electrode and the focusing electrode.

21. The storage apparatus according to claim 15 wherein the solid-state field controlled emitter is a flat emitter.

22. The storage apparatus according to claim 15 wherein the solid-state field controlled emitter conforms to a tip-based geometry.

23. The storage apparatus according to claim 15 wherein the electron emission device further comprises means of addressing said electron beams to storage areas on the storage medium by a motion relative to one another.

24. The storage apparatus according to claim 15 wherein the electron emission device further comprises means for addressing the electron beams to storage areas on the storage medium by beam steering.

25. A method of improving electron emission under partial vacuum within a solid-state field controlled emitter, comprising:

forming a junction between a high-electrical conductivity material and a low electron affinity material;

injecting electrons across the junction from the high-electrical conductivity material to the low electron affinity material;

applying an electric field across the junction sufficient enough to induce electron emission from the low electron affinity material through the partial vacuum to an information storage location within the high-density information storage device to perform a read or write operation.

26. A method of improving electron emission as claimed in claim 25 also comprising forming the high-electrical conductivity material on an emitter electrode.

27. A method of improving electron emission as claimed in claim 25 also comprising forming an extractor electrode proximate the low electron affinity material, the extractor electrode utilized to apply the electric field.

28. A method of improving electron emission as claimed in claim 27 also comprising forming a focusing electrode proximate the extractor electrode.

29. A method of improving electron emission as claimed in claim 26 also comprising forming a tip-based geometry on the emitter electrode.

30. A method of improving electron emission as claimed in claim 25 also comprising modulating the applied field to control the induced electron emissions from the low electron affinity material.

31. A method of improving electron emission as claimed in claim 25 wherein the junction has a barrier height ranging from 0.1 eV to 2.0 eV.